Best Practices and Review Comments Regarding the Vapor Intrusion Mitigation Work Plans

dated May 18, 2012, and submitted by Conestoga-Rovers & Associates

To: USEPA Region 5, Karen Cibulskis
From: CH2M HILL
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Introduction

Conestoga-Rovers & Associates (CRA) is currently performing a Vapor Intrusion (VI) Study at the South Dayton Dump and Landfill site (the Site) in Moraine, Ohio, on behalf of the Respondents to the Administrative Settlement Agreement and Order on Consent for Remedial Investigation/Feasibility Study (RI/FS) of the Site, Docket No. V-W-06-C- 852 (ASAOC).

CRA performed the Round 1 and Round 1 Follow-Up sampling events in January and March 2012, respectively. Three buildings have been identified so far in which the VI pathway is complete and significant (that is, causing indoor air volatile organic compound (VOC) concentrations to exceed regulatory target levels). Additionally, a fourth building was identified where subslab soil gas concentrations of explosive gases exceed 100 percent of the lower explosive limit (LEL). Therefore, mitigation of the VI pathway is required at these four buildings.

CRA submitted mitigation work plans for three buildings (numbers 2 – 4 below) to the U.S. Environmental Protection Agency (USEPA) Remedial Project Manager for review on May 18, 2012. (Separate work plans were submitted for the two separate halves of building number 4 below.) However, it was agreed in subsequent discussions between CRA and USEPA (documented in a June 26 e-mail from CRA) that the Respondents will proceed directly with the testing, design, and installation of sub-slab depressurization systems (SSDSs) at these buildings rather than waiting until after crack sealing and ventilation adjustments have been attempted due to the magnitude of indoor air VOC detections. Mitigation of the VI pathway will be performed by the building owner at the fourth building (number 1 below).

Additional Data Evaluation Required

CRA must complete the required data evaluation before proceeding with determination of necessary and appropriate actions to address the VI pathway at the VI Study buildings. Specifically, CRA must calculate cumulative cancer and non-cancer risks in subslab soil gas and indoor air samples in accordance with Section 8.1.1 of the USEPA Region 5 VI Guidebook (USEPA, 2010) and Sections 5.3 and 5.4 of the *VI Investigation Work Plan* (USEPA, 2011). Although it is not specified in either document, measured indoor air concentrations of VOCs that are not attributable to the VI pathway (that is, determined to be likely resulting from indoor VOC sources and/or outdoor air based on a multiple lines of evidence evaluation) should not be included in the cumulative risk calculations.

The following review comments were prepared assuming that as-yet completed cumulative risk calculations will not change the categorization of the buildings as described in Section 8 of the USEPA Region 5 (2010) VI Guidebook. It is also possible that additional buildings requiring mitigation may be identified from the cumulative risk evaluation.

VI Study Buildings Requiring Mitigation

Four buildings at the South Dayton Dump site require VI mitigation based on the results of the Round 1 VI sampling events performed in January and March 2012, and in accordance with the USEPA (2011) VI Work Plan and the USEPA Region 5 (2010) VI Guidebook:

1. Parcel 5054, Building 2 – 1903 Dryden Rd – Valley Asphalt
    a. Explosive gas concentrations (primarily methane) in one of the two subslab soil gas probes exceeds 100 percent of the LEL – measurements performed weekly since the January 2012 sampling event.
2. Parcel 5173, Building 1 – 2031 Dryden Rd – SimTrainer
    a. The measured concentration of trichloroethene (TCE) in one of the three indoor air samples was above the indoor air screening level (IASL) based on a hazard index (HI) of 1 and is likely the result of VI due to the measured TCE concentrations in subslab soil gas and outdoor air.
    b. Explosive gas concentrations (primarily methane)in one of the three subslab soil gas probes exceeds 10 percent of the LEL – measurements performed weekly since the January 2012 sampling event.
3. Parcel 5171, Building 2 – 1951 Dryden Rd – B&G Trucking
    a. The measured concentration of TCE in one of the two indoor air samples was above the IASLs based on an HI of 1 and an excess lifetime cancer risk (ELCR) of 10^{-5} and is likely the result of VI due to the measured TCE concentrations in subslab soil gas, outdoor air, and the empirical attenuation factor (AF) calculated from the radon tracer gas data. Although TCE was not detected in the second indoor air sample, the reporting limit was above the IASL based on an HI of 10.
4. Parcel 5172, Building 1 (this building is divided into 2 separate halves by a concrete block wall)
    a. 2015 Dryden Rd – S&J Precision
        i. The measured concentrations of TCE in two of the three indoor air samples were above the IASL based on an HI of 1 and are likely the result of VI due to the measured TCE concentrations in subslab soil gas, outdoor air, and the empirical AF calculated from the radon tracer gas data.
    b. 2019 Dryden Rd – Overstreet Painting
        i. The measured concentrations of TCE in the two indoor air samples were above the IASL based on an HI of 1 and is likely the result of VI due to the measured TCE concentrations in subslab soil gas, outdoor air, and the empirical AF calculated from the radon tracer gas data. The measured concentration of TCE in one of the two indoor air samples was equal to the IASL based on an ELCR of 10^{-5}.

Categorization of the Buildings

Building 2 on Parcel 5054 (number 1 above, the Valley Asphalt Quonset Hut) falls under Category 5 as discussed in Section 8.2.5 of the USEPA Region 5 (2010) VI Guidebook because methane is present at concentrations greater than 10 percent of the LEL in subslab soil gas. Therefore, rapid mitigation (that is, within weeks) of the VI pathway is required at this building. The property owner, Valley Asphalt, has agreed to perform the mitigation and will be submitting a mitigation work plan to EPA for review. The building has been kept vacant by Valley Asphalt since the discovery of elevated methane levels in the subslab soil gas. Additionally, CRA is performing weekly methane monitoring.

The remaining three buildings (numbers 2 – 4 above) fall under Category 3 (remedial site with removal support) as discussed in Section 8.2.3 of the USEPA Region 5 (2010) VI Guidebook because the measured indoor air concentrations resulting from the VI pathway are greater than IASLs based on an HI of 1 or an ELCR of 10^{-5}, but less than IASLs based on an HI of 10 or an ELCR of 10^{-4}. Therefore, mitigation of the VI pathway is required at these buildings.

The following statement regarding actions for Category 3 buildings is noted from the USEPA (2011) VI Work Plan:

> *If site-related indoor air VOC levels due to VI meet or exceed applicable IASLs or cumulative risks/hazards corresponding to a target ELCR of $1x10^{-5}$ or HI of 1 at any indoor air sample location within a building during any sampling event, then CRA will submit a work plan on behalf of the Respondents within 30 days of receiving the complete set of preliminary analytical data for that sampling event to perform mitigation (including operation and maintenance) to address the human health risk at that building. Additionally, interim mitigation measures should be performed at occupied buildings to reduce potential indoor air VOC concentrations due to VI such as HVAC modifications (e.g., increasing the outdoor air intake) and sealing cracks and other entry points in the slab or floor.*

Interim Mitigation Measures

The intent of the USEPA (2011) VI Investigation Work Plan is that interim measures should be performed to reduce concentrations of VOCs in indoor air resulting from the VI pathway at occupied buildings requiring mitigation while work plans for more permanent, long-term mitigation measures are being prepared. Suggestions for interim measures provided in the Work Plan include HVAC modifications (such as increasing the outdoor air intake) and sealing cracks and other entry points in the slab or floor. The intent is that such measures could be performed without development of a detailed work plan, and then EPA and other stakeholders would be informed via e-mail.

USEPA still encourages interim mitigation measures at the three buildings (numbers 2 – 4 above) while the mitigation work plans are being finalized; however, interim measures are not necessary at this time at Building 1 because it is not occupied and indoor air is currently not being affected above regulatory screening levels by the VI pathway.

HVAC Modifications

HVAC modifications may be performed to increase outdoor air exchange and/or create positive pressure within the building; however, the feasibility of this action is dependent on each individual building's air handling system and the air-tightness of the building.

The following considerations are provided for CRA's consideration during planning and implementation of HVAC modifications as an interim measure:

1. HVAC systems should be evaluated by experienced HVAC personnel to determine if the equipment is serviceable and can be modified to function as a VI mitigation measure.
2. Repairs or upgrades to an HVAC system may be required before the equipment can be used to mitigate VI.
3. Impacts to utility costs should be evaluated because HVAC modifications typically result in the use of increased makeup air that must be heated in winter and cooled in summer.

Crack/Floor Sealing

Sealing cracks or the entire floor may be performed to reduce and/or prevent entry of subslab soil gas into the indoor air. VI entry points are typically full-depth cracks in the floor slab, utility penetrations,

structural penetrations (such as columns, shafts, etc.), and expansion joints in the concrete floor and perimeter where it meets the foundation. Each of the buildings requiring mitigation (numbers 2 - 4 above) have on-grade concrete slabs that are in fairly good condition with some significant cracks; therefore, sealing approaches should be implemented at each building.

The following recommendations are provided for CRA's consideration during planning and implementation of sealing as an interim measure:

1. Consider surface preparation requirements (crack grinding, surface cleaning [sand blasting/pressure washing], and need for backer rod for crack depth control).
2. Concrete floor surface repair may be necessary before sealing the floor.
3. Gaining access to cracks may require moving building contents, which may significantly affect building operations.
4. Floor sealing typically results in poor indoor air quality for several days while the sealants cure. Therefore, the building cannot be re-occupied until the sealants have properly cured.

General Comments on the Use of SSDSs

The installation of SSDSs should include the following elements:

- Pre-Design Diagnostic Testing
- Data evaluation
- Design
- Procurement
- Construction
- Startup
- Operations & Maintenance (O&M)

Pre-Design Diagnostic Testing

A pre-design diagnostic testing work plan should be prepared that describes the procedures and equipment necessary to conduct the testing and meet the testing objectives. The work plan and pre-design diagnostic testing process should address the following:

- Evaluation of the physical properties of the structure, with emphasis on the portion(s) of the structure where VI is likely to occur. This information ultimately guides the placement of both SSDS nodes and the mitigation infrastructure such as fans, piping, wall penetrations, etc.
- Installation of SSDS nodes (or subslab vacuum extraction point[s]), and subslab pressure monitoring points.
- Application of negative pressure to the subslab environment and measurements of the pressure field extension and flow rates. Extracted soil gas should be vented to the outdoors and not discharged inside the structure.
- During the dynamic testing process, collection of exhaust soil gas samples for laboratory analyses to evaluate potential air emission permitting and off-gas treatment requirements.

Data Evaluation

The data evaluation process should include the following elements:

- Review of the pressure and flow measurements.
- Identification of the radius of influence that can be achieved at a given location at a given negative pressure and flow rate.

- Identification of barriers to subsurface flow so that the number and location of SSDS nodes can be determined.
- Evaluation of the subslab soil gas data against air permitting requirements and the determination of whether off-gas treatment may be required.

Design

Using the findings from the data evaluation, the SSDS layout will be designed and appropriate equipment will be selected. An operational configuration for the SSDS will be developed to balance receptor protection with reliability and sustainability of system operation. The following elements should be considered during the design stage:

- The location and quantity of SSDS nodes will be selected.
- The location and quantity of subslab pressure monitoring ports will be selected.
- Mitigation fans with the required vacuum and flow rates will be selected.
- The type and locations of extraction piping will be selected.
- The type and locations of pressure and flow monitoring equipment will be selected. Each SSDS fan shall be fitted with a U-tube manometer to monitor pressure and port with valve for collecting flow measurements. These monitoring locations should be accessible from the exterior of the structure to minimize the intrusion on building occupants.
- Identify locations that require sealing so that lower operational costs can be achieved and specify appropriate sealing materials.
- Prepare plans and specifications for the SSDS.
- Prepare the O&M plan for each SSDS.

Procurement

Prepare final specifications and bid packages, in accordance with company procurement processes.

- Identify qualified bidders for the SSDS installation and solicit bids.
- Review bids, negotiate, and award the SSDS installation work to the successful bidder.

Construction

- Sealing of larger cracks, utility penetrations and other VI entry points must be part of an SSDS system. Crack and floor sealing for an SSDS is not as critical as with a sealing-only approach; however, smaller SSDS fans may be utilized if a larger negative pressure field beneath the slab can be obtained with crack sealing. This could result in lower capital and utility costs for the SSDS installation and operation.
- The design should be implemented by a qualified contractor who should obtain the necessary permits and shall install the SSDS using licensed personnel when required (for example, a licensed electrician for installation of electrical wiring and connections for the mitigation fans).

Startup

Once the SSDS has been installed, the installation contractor needs to demonstrate that the system is operational and functional and meets the design requirements. The following elements should be considered:

- Baseline pressure, flow, and extraction flow concentrations shall be measured.

- Pressure measurements shall be collected from the subslab monitoring points to evaluate the negative pressure field extension beneath the structure.

Operation and Maintenance

O&M shall be performed each time monitoring is performed (see Section 10.3 of Region 5 VI Guidance). O&M shall include an evaluation of all of the visible system components for damage or other upset conditions; proper operation of the fans, manometers, and sampling ports; and a comparison of the current measurements of flow and pressure against prior measurements to look for changes that could indicate upset conditions (such as fan wear, pipe restrictions, or water in pipes).

Monitoring during the O&M stage should follow the USEPA Region 5 (2010) VI Guidebook. If installed appropriately, monitoring can be conducted with reduced impacts to the building occupants because the vacuum and flow measurements can be collected from the exterior of the structure. Monitoring of the active SSD systems should include the following:

- Concurrent collection of outdoor air samples for comparison against indoor air samples, when considering background sources of air contaminants. The USEPA Region 5 (2010) VI Guidebook does not explicitly require this, but it should be considered as a means to more efficiently evaluate the SSDS.
- The first indoor air (IA) sampling should be performed 30 days after system installation.
- The second IA sampling should be performed 180 days after system installation.
- The third IA sampling should be performed 1 year after system installation.
- Although the USEPA VI Guidance does not address seasonal sampling, indoor air sampling on a quarterly basis during the first year of operation, with two events performed during warm weather (cooling season) and cold weather (heating season), could be beneficial for efficiently evaluating the SSDS. After the first year, indoor air sampling could be conducted on a semiannual basis, with sampling performed during warm weather and cold weather.
- Although the USEPA VI Guidance does not specify frequency of monitoring, measurements of pressure and flow from the SSDS mitigation fan inlet piping should be collected quarterly for the first year and then semiannually thereafter. Pressure measurements shall be collected quarterly for the first year and then semiannually thereafter from the subslab monitoring points to evaluate the negative pressure field extension beneath the structure.

Questions and Comments Specific to the Mitigation Work Plans dated May 18, 2012 Submitted by Conestoga-Rovers & Associates (CRA)

1. The work plans should be titled “Vapor Intrusion Mitigation Work Plan…” instead of “Explosive Gas Mitigation Work Plan…” because not all mitigation plans address explosive gas issues exclusively.
2. These work plans do not need to include installation of explosive gas monitoring systems unless explosive gases were measured in the subslab soil gas at concentrations exceeding 10 percent of the LEL. However, installation of explosive gas monitoring systems at all of the buildings on the site will be addressed as part of the final landfill remedy for the site.
3. The “floor drain” in the B&G Trucking Building (number 3 above) warrants further discussion and investigation; it is a subslab pit that houses a 55-gallon drum. It is unknown if the pit is sealed with concrete, if not, this may be a significant VI pathway. Also, the location of this

"floor drain" does not appear to be accurate on the work plan figure; it is located closer to the north side of the building.

Interim Measures

1. Crack sealant is described as hydraulic cement or VOC-free sealant, but additional specific details should be provided on the brand and type of sealant proposed for crack sealing activities. Please reference the email discussion with USEPA on use of the Quikrete Hydraulic Water-Stop cement.
2. The work plans currently state, "The Respondents will recommend to the property owner and tenant that positive indoor pressurization be implemented, if suitable, based on building conditions and business operations." If the property owner and tenant are to complete these modifications, it is still the Respondent's responsibility to document the specific modifications that were made, ongoing monitoring, and demonstrating effectiveness. Additional specific details should be provided on the specialists and procedures that will be employed to complete the HVAC adjustments; please reference the email from EPA Region 5 to CRA on May 21, 2012, and the applicable sections of this document. It should also be noted that these HVAC modifications generally result in increased utility costs.

Active SSDS

1. The work plans state that a State of Ohio Department of Health-licensed and insured Radon Mitigation Contractor/Specialist will install the SSDS. Will this individual also carry out the diagnostic testing?
2. Details should be provided on the specific procedures, locations of suction nodes and monitoring points (presented on figures), and reporting of results for the diagnostic testing proposed.
3. SSDS details should be provided in a separate remedial design document after the diagnostic testing is completed (referred to as *Vapor Intrusion Mitigation System Design Report* in the Mitigation work plans) and include:
    a. pressure field extension test results (tables and figures)
    b. soil resistance vs. fan curve graphs
    c. justification of mitigation fan(s) or blower(s) chosen for installation
    d. system layouts
    e. cost estimates
4. Consider producing a separate addendum, appendix, or report to the *Mitigation System Design Report* to present the Performance Monitoring Plan (Post-Installation Proficiency Sampling)
5. Recommend amending the frequency of post-installation proficiency sampling based on excerpt from USEPA Region 5 (2010) VI Guidebook Section 10.1.1:
    a. The first IA sample should be collected 30 days after system installation.
    b. The second IA sample to be collected 180 days after system installation.
    c. The third IA sample can be collected 1 year after system installation.
6. Annual IA sampling and/or SSDS inspections (described in Section 10.5) can be performed after the first year.

7. Recommend concurrent outdoor air sampling with indoor air sampling proposed during the *Post-Installation Proficiency Sampling* described in the work plans.
    a. Indoor air data monitors the effectiveness of the systems.
    b. Comparison of the indoor air to the outdoor air will provide information on whether outdoor air concentrations are influencing the indoor air concentrations.
8. Recommend the collection of exhaust samples from the exhaust vents of the SSDS blowers/fans to ensure exhaust concentrations meet Title V emissions standards.
    a. Exhaust data can be used to estimate steady-state discharge concentrations and mass discharge rates for the SSDS.
    b. Exhaust data can also be used to assess how the operation and discharge of untreated exhaust vapors to the atmosphere may influence outdoor air.
9. Recommend submittal of a Contingency Plan as part of the *Vapor Intrusion Mitigation System Design Report* to address a situation where sufficient negative pressure drop is not achieved (at all four buildings identified for mitigation) or should indoor air or subslab explosive gas concentrations increase (in the case of SimTrainer Building).

Explosive Gas Monitoring Systems (SimTrainer Building Only)

1. The locations of the sensors for the explosive gas monitoring system should be indicated on a figure and described specifically in the text.
2. An instructional technical memo should be provided for the tenants/owners in the event that the explosive gas monitoring system is triggered, and include:
    a. Procedures for operation and maintenance of the system.
    b. Procedures for responding to the alarm, notification of emergency agencies (police, fire department, etc.).